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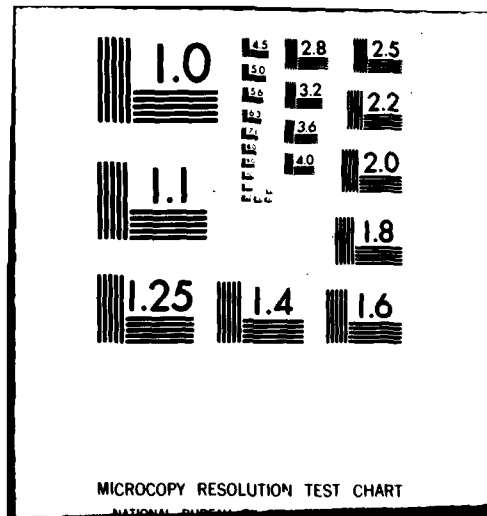
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MARINE SCIENCE IN SOUTHERN WALES

WAYNE V. BURT

5 NOVEMBER 1980

UNITED STATES OF AMERICA

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7 policy, shipping economics, marine geology, and marine meteorology. Some deep sea and Bristol Channel seismic research is also underway in the Geology Department of the University College of Wales in Cardiff. ↑

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MARINE SCIENCE IN SOUTHERN WALES

THE DEPARTMENT OF OCEANOGRAPHY AT THE UNIVERSITY COLLEGE OF SWANSEA

Swansea is a major port, largely dependent on maritime trade and marine-oriented recreation. In the mid-1960s Swansea suffered a recession. During this time the idea developed within the university that an oceanographic research program might be of assistance to the economy of the city. It was decided to start the program within the already established Geology Department which, in 1967, became the Department of Geology and Oceanography.

It is customary in British universities to call in outside "assessors" to help decide whether a new department should be established and to aid with the planning of its activities. The two assessors for oceanography were the "deans" of British oceanography, Sir George Deacon, founder and formerly head of the UK Institute of Oceanographic Sciences, and Sir Alister Hardy, professor emeritus from Oxford University and renowned for voluminous publications in marine biology.

Dr. F.T. Banner, a geologist with the British Petroleum Corporation, was brought in to head up the new oceanography program at its inception. Undergraduate teaching began in 1968 with 30 students, and the first graduates in oceanography received their degrees in 1970.

The oceanography program continued to grow until it became a separate department in 1976, nine years after its inception. A good deal of effort has gone into the teaching program in oceanography. Until this year students could work toward a joint honors degree in oceanography and one of the following sciences: mathematics, botany, chemistry, geology, geography, microbiology, zoology, or topographic science. About half of their courses during the last two years were in oceanography. One hundred and thirty-three students have received their master's degrees, and 19 have received PhD degrees in oceanography. When queried as to where the students go after graduation, Banner stated that to the best of his knowledge all of the department's graduates were gainfully employed in marine-oriented activities.

Beginning this fall new students may elect to take the joint honors degree or a single honors degree in oceanography. Ten are enrolled in each category.

I was impressed by the "hands on" side of the teaching effort. The largest room in the oceanography department is a teaching laboratory where each student has his station. Until this year the seniors were taken on a 10-day field trip to the Baltic Sea (due to the current financial situation, this year's trip was in Wales). They are given about 3 months to write up the results of the field trip, and one-third of their final grade depends on this report. In addition, all the students are required to keep very complete, individual laboratory manuals with write-ups on all their laboratory work as well as the cruises that they participate in. This counts for another third of their final grade. The final third comes from the results of a comprehensive examination. Students are given lectures on the mechanics of re-

search report writing and the ability to write well is considered very important.

Ninety-five percent of the undergraduate students in oceanography are British while only forty percent of the graduate students are British, the remainder being from overseas. Unless the overseas students' parents have paid British income taxes during the past three years, their tuition and room and board cost them about \$14,000 per year.

The oceanography department operates two 10-m-long research launches for inshore and estuarine work. During my visit all the staff members (except Banner) and senior students were carrying out their annual 10-day field trip with the launches in a survey of Milford Haven Bay. The department also operates its own 30-m-long research vessel *OCEAN CREST*, a converted Lowestoft trawler. In addition to the research vessels, the department appears to be well provided with up-to-date research equipment including a combined wave-sediment movement research tank. It is housed in two buildings right in the center of the campus. When I visited in September, 1980, the department was in a state of complete chaos. Both buildings were being completely renovated from top to bottom and a new small building was under construction between the two older buildings.

About half of the research funding comes from contracts with various industries. Studies include: the distribution of heavy metals in sea water and sediments for the British Steel Corporation, PCB levels in sediments for the British Petroleum Corporation, storm-surge height and frequency that threaten a plant of the Metal Box Company, movement of commercially valuable sands for a dredge company, and mercury in sediments for a chemical company. Shell, Conoco, and BP all give small unrestricted grants to the department.

The department has very close links with the Institute of Marine Biology and Oceanography, Fourah Bay College (Univ. of Sierra Leone). Every year one or more (up to four) staff members visit the institute to help with research and teach classes. Banner also took part in a survey of the Volta estuary in cooperation with the University of Ghana at Legon. In addition, the staff has research links with the University of Patra in Greece.

Banner's own research is concerned with foraminifera and sedimentology. He is carrying out research into the ecology and characteristics of intertidal-marsh foraminifera from the south coast of Wales and into the foraminiferal assemblages, paleoecology, and paleoenvironment of late Pleistocene and Flandrian deposits of adjacent onshore and offshore areas.

Dr. M.B. Collins is interested in dynamical sedimentology and the dynamical oceanography of continental shelves and estuaries including the effects of tides, waves, and currents on sediment movement and sea/seabed interactions. Much of his research has been on sediment movement in the Bristol Channel and adjacent embayments. He has also studied the surface circulation in the northeastern Mediterranean, using ERTS imagery and Secchi disc measurements to estimate the amount of sediment in suspension near the surface and then inferring water movements from these estimates.

Dr. P.A. Tyler is a biological oceanographer whose main interests are the ecology, reproduction, growth, and identification of echinoderms and benthos/seabed interaction. He studies the distribution of benthic echinoderms in relation to dynamic oceanographic forces and the resulting dynamic sedimentology.

Dr. A.E. James is the "physical" oceanographer although his interests are largely geological in nature. He studies the characteristics of inorganic suspensions, fluid flow, and the rheology of muds. He is presently studying the vertical distribution of mobile sediments in the Severn River estuary in relation to the vertical distributions of current velocity and turbulent structures. He also does research on the effects of marine and estuarine chemical environments on the colloidal properties and flow behavior of fine sediments and the role of interparticle forces on their macroscopic properties.

Mr. J.S. Wakefield is the "chemical" oceanographer but again his research has a geological slant. He is mainly interested in the chemical species present in marine sediments.

Dr. S.E. Shackley is the latest (temporary) addition to the senior staff of the department. Shackley's main interest is the biology of fishes.

INSTITUTE OF MARINE SCIENCE

Several years ago it became apparent that marine studies of all sorts were being conducted by individuals in a number of departments on the campus of the University College of Swansea besides the programs in the department of oceanography. An Institute of Marine Studies was set up to coordinate all marine related programs in the university. One of the aims of the institute was to prepare the university staff for "Total Systems" studies in which individuals from a number of disciplines could make integrated studies of the impact upon biological, chemical, economic, and sociological systems by major construction projects such as the proposed Severn River barrage, the oil industry in the Celtic Sea, or the construction of large marinas.

Chemistry

The part-time director of the Institute of Marine Studies is Dr. J.A. Ballantine, a senior lecturer in chemistry. In his year-and-a-half tenure, Ballantine has started a collection of reprints on marine science for the whole university, he has collected vitae on all marine oriented researchers, and he has issued some newsletters on marine research activities at the university.

Ballantine is an organic chemist. In collaboration with Prof. A. Pelter he works out the structure and physiological activity of important marine compounds. In one such effort, they have worked out the structure of Bonellin and its derivatives from Bonellia Verdis. This unique compound is the only compound that determines the sex of an animal after birth. If larvae do not touch an adult female after birth, they develop into mature females with trunks about 5 cm long and a forked proboscis up to 1.5 m long. If the larvae

touch a female proboscis they immediately stop growing and turn into parasitic males only 1-3 mm in length and live within the female's body. Bonelin, which is very toxic to larvae of other species, has been studied for over 100 years. It has two reasons to be important. If it could be synthesized it might be a nonmetallic ingredient in antifouling paint for ships' bottoms, and because of its ability to limit growth it might have a potential for cancer therapy. Ballantine and his collaborators have also written eight papers on the sterol compositions of marine organisms.

Chemical Engineering

Dr. J.A. Williams is carrying out a major research project on biodegradation of trace pollutants in estuaries.

Economics

Dr. N. Baigent is working on the economic theory of fisheries, an economic analysis of the effects of extending fishing limits to 200 m/s, the economics of aquaculture in Malaysia, and a cost-benefit analysis of British trawler operations.

Geography

Prof. N. Stephens is working on present and relict elevated marine shorelines and associated deposits in England and Ireland.

Dr. A.H. Perry is carrying out research in air-sea interaction with special emphasis on the influence of sea-surface temperature anomalies on atmospheric circulation. In 1977 he published a book with Dr. V.M. Walker entitled "The Ocean Atmosphere System", Longmans, London.

Metallurgy and Materials Technology

Dr. D.E. Davis has a grant from the Ministry of Defence, and in collaboration with the Admiralty Underwater Research Establishment at Portland is studying the cathodic protection of aluminum in sea water.

Mechanical Engineering

Prof. J.M. Alexander has an interesting ongoing project. He is studying the feasibility of an immersed (as distinct from a bored) tunnel between Dover and Cap Gris Nez in France.

Civil Engineering

Dr. R.F. Allen is a mathematical modeler working in the Fluid Mechanics Laboratory. In the past he has studied deltaic development with small-scale physical models. Now he uses computer-mathematical models. At the present time he is beginning numerical simulations of flow in estuaries.

Dr. A. Luxmore, in collaboration with scientists from the Admiralty

Materials Laboratory, Holton Heath, and the Admiralty Marine Technology Establishment, St. Leonard's Hall, has investigated the mechanical properties of syntactic foams for use in submersibles. Presently he is carrying out research on fracture analysis of steels used in submersibles.

Prof. O.C. Zienkiewicz is heavily involved in marine studies. He works with Dr. Allen on Mechanics of delta formations, with Drs. P. Bettes and C. Taylor on new models and techniques for the computation of tidal currents in estuaries, with Dr. Bettes and Mr. I. Austin on the computation of wave/wind induced currents and with Dr. Bettes on the computation of wave diffraction and refraction and wave forces on coasts and offshore structures.

Pure Mathematics--Sea Birds

Dr. D.K. Thomas of the Department of Pure Mathematics is seriously involved in the study of local shore birds and has organized a continuing shore-bird survey of three local shires.

Geology

Prof. T.R. Owen is interested in the geology and geological structure of British sea areas, with special emphasis on the nearby Bristol Channel. His expertise is mainly on the identification of geological horizons, and he is frequently called upon for advice on underwater geological structures.

Dr. Peter Styles has recently completed a magnetic, gravity, and bathymetric study of the western Gulf of Aden and the Red Sea. Now he is working on magnetic, gravity, bathymetric, and seismic surveys of the northwest Indian Ocean.

Dr. T. Elliot is studying the hydrodynamics and sediment transport in river-mouth areas of major river deltas and subaqueous dune bedforms in estuaries with particular emphasis on Loughor estuary, South Wales.

Zoology

Prof. E.W. Knight-Jones collaborates with his wife, Phyllis, in the study of the nervous systems, behavior, and embryology of enteropneusta (hemichordata), larval settlement behavior of oysters, barnacles and tube-worms, sensitivity and responses of marine animals to hydrostatic pressure, and faunistic studies contributing to taxonomy and ecology, particularly of fish, leeches and tubeworms.

Dr. John Moyse's areas of interest are barnacles and antifouling, rocky-shore ecology with particular emphasis on barnacles and gastropods, commercial shellfish breeding, and laboratory culturing of marine invertebrates. He also manages the marine biology laboratory on the campus.

Dr. Anthony Nelson-Smith has research interests in the effects of dispersed oil on filter feeding animals, the ecology of estuaries, the biology of sabelliform tubeworms, coastal conservation, and fouling of marine structures.

THE DEPARTMENT OF MARITIME STUDIES OF THE UNIVERSITY OF WALES - INSTITUTE OF SCIENCE AND TECHNOLOGY (UWIST)

UWIST was called the Welsh College of Advanced Technology until 13 years ago, when it became the 5th of the 7 colleges making up the University of Wales.

The Department of Maritime Studies taught professional mariners. Four years ago this training program was shifted to a new technical college in Cardiff, South Glamorgan Institute of Higher Education (SGIHE). The head of the department is Dr. Alistair Couper. Now, research and training is done in many marine oriented areas with the exception of the actual operation of the ships.

The staff consists of 3 professors, 3 senior lecturers (associate professors), and 7 other senior staff members who are involved in research and also do some teaching. About a dozen students are usually in residence working on their MS or PhD theses. Approximately 160 undergraduate students at the institute are taking one of four courses: BSC Maritime Technology, BSC Maritime Geography, MSC Maritime Commerce, and BSC International Transport. The maritime geography course is unique in the UK if not in the world. The curriculum is a mix of surveying, cartography, economics, the law of the sea, marine resources, and technology. A good deal of time is spent on practical work beginning in inshore waters and moving to deep water. It is a favorite of ship's officers who want to come ashore.

A diploma, one-year postgraduate course is given to overseas students in port administration and shipping. Forty to fifty students are usually enrolled in this course.

Two "taught" MSC courses are available. One, in sea law and policy is taught jointly with the law department. The second, in shipping economics is taught jointly with the Department of Business Administration.

I interviewed three staff members who are doing research in marine science. Dr. C.M. Davis, a graduate of the Department of Oceanography in Swansea, has spent most of his research time recently on problems related to the proposed Severn River Barrage. He is mapping the distribution of consolidated and unconsolidated sediments in the areas proposed for the barrage, and is determining the suitability and distribution of bottom materials that may be used as aggregates and fill material. In the past five years Davis has run 100 km of high-resolution seismic profiling, has covered 250 sq km with side-scan sonar, and has analyzed 360 bottom sediments. He has now begun to study the very complex sedimentation environment near the mouth of the Bristol Channel with emphasis on Barnstable Bay and around Lundy Island between Barnstable and Swansea.

Dr. J.M. Walker is a physical oceanographer-meteorologist. His main interest has been in the Indian Ocean monsoon regime, and he is writing a textbook on the subject. He has also made a study of wave conditions in the Celtic Sea in collaboration with Dr. L. Draper of the Institute of

Oceanographic Sciences, Wormley. This was a background study for oil exploration in the area. In addition, Walker is the co-author with Dr. Perry of the book, "The Ocean Atmosphere System" (see above).

Since he joined the staff, Dr. C. Woodbridge has spent most of his time working on a large contract from the Times Publishing Co., London, to produce the Times Atlas of the Oceans. Woodbridge also does some work with Evans, trying to unravel the complex sedimentary environment of the Bristol Channel and relate it to the tidal regime. Woodbridge is not an oceanographer. His interests are marine economics, planning, and use of the sea.

The Department of Maritime Studies appears to be quite successful in helping the UK with its various marine problems. The institute is due to move into a large, new, especially designed building within the next three years. The UK Department of Trade recently announced that it is purchasing a 3.6 million dollar, latest-state-of-the-art ship simulator which will be operated by the Department of Maritime Studies. It is a prototype presently being constructed by Marconi and due for installation in April, 1981. Rated to be one of the most advanced simulators of its type in the world, it uses computer imagery rather than models to generate all of the pictures (for a discussion of the use of such simulators see ESN 34-8:406 [1980]). SGIHE will use the simulator to train ships' deck officers, while UWIST will use it for research.

Research will be done on information, presentation, bridge design, collision-avoidance strategies, human performance under stress conditions, the analysis of accidents both from a legal and a maritime viewpoint, the design of ports and navigational aid systems, and the development of operational strategies to cope with the effect of ship failure.

SGIHE operates a 110-ft-long training vessel, *MARGHERITA*, which is frequently used by the staff of UWIST.

UNIVERSITY COLLEGE CARDIFF DEPARTMENT OF GEOLOGY

Dr. M. Brooks is a geophysicist in the Department of Geology. His most recent research was an air-gun and sparker study of the structure and evolution of the Sporades Basin of the North Aegean Trough, Northern Aegean Sea. Previously he made very detailed refraction studies of the Bristol Channel.

Brooks has a Natural Environmental Research Council grant to support a second Aegean Sea study. The cruise is scheduled for December, 1981/January 1982.